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An Assessment of New Zealand's Performance in Environmental Leadership in Antarctica

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Abstract/executive summary (ca. 200 words):

New Zealand established a position of environmental leadership throughout the negotiations on the Protocol. New Zealand's performance in environmental leadership since then was assessed under the Antarctica (Environmental Act) 1994 and in its contribution to the Committee on Environmental Protection (CEP). The Antarctic Treaty Secretariat database was used to retrieve information on the number of Environmental Impact Assessments approved. New Zealand's performance was then measured by the compliance of its Crown Entity, Antarctica New Zealand with the conditions of its approval which covered the operation of Scott Base and all field events supported by Antarctica New Zealand. This showed only minor non-compliances with less than minor impact. The number of Initial Environmental Evaluations was benchmarked against other countries and showed New Zealand received substantially more than every other party except the United States. New Zealand's international contribution was measured by its contribution to comments on Comprehensive Environmental Evaluations (CEE) and on the number of Working Papers submitted to the CEP. New Zealand is one of a few countries regularly submitting on CEEs and submits more Working Papers than every party except the United Kingdom. When normalised by the GDP New Zealand stands out in its engagement with the CEP. 3 Case studies are used to provide more detailed examination.

An Assessment of New Zealand's Performance in Environmental Leadership in Antarctica

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Acronyms

ASMA	Antarctic Special Management Area
ASOC	Antarctic and Southern Ocean Coalition
ASPA	Antarctic Special Protected Area
ATCM	Antarctic Treaty Consultative Meeting
ATS	Antarctic Treaty System
BOD	Biological Oxidation Demand
CALM	Circumpolar Active Layer Monitoring
CEE	Comprehensive Environmental Evaluation
CEP	Committee on Environmental Protection
CCAMLR	Convention for the Conservation of Antarctic Marine Living Resources
cfu	colony forming unit
CRAMRA	Convention for the Regulation Antarctic Mineral Resource Activities
EIA	Environmental Impact Assessment
HSM	Historic Site and Monument
IAATO	International Association of Antarctic Tourism Operators
ICG	Intersessional Contact Group
IEE	Initial Environmental Evaluation
IP	Information Paper
MFAT	Ministry of Foreign Affairs and Trade
MPA	Marine Protected Area
NGO	Non-Governmental Organisation
PEE	Preliminary Environmental Evaluation
SCAR	Scientific Committee on Antarctic Research
SCM	Special Consultative Meeting
SPA	Special Protected Area
SS	Suspended Solids
WP	Working Paper

Introduction

The signing of the Protocol on Environmental Protection to the Antarctic Treaty (the Protocol) marked an historic milestone for Antarctica and for the Antarctic Treaty System (ATS).

Six years of tortuous negotiations, chaired by New Zealand, to develop controls on mining in Antarctica reached a conclusion in 1988 with agreement on a Convention on Regulation of Antarctic Mineral Resources (CRAMRA). Chris Beeby (as cited in Templeton, 2017, p. 222), who chaired the Special Consultative Meeting, commented in a press release that the convention was the most important political development in the regulation of Antarctica since the conclusion of the Antarctic Treaty and far from being an invitation to start mining was "quite the reverse."

The Convention, however, was never ratified. Opposition from Non-Government Organisations (NGOs), second thoughts by France and Australia, and two polar sea disasters in 1989 (sinking of the Bahia Paraiso and Exxon Valdez) led to its demise. Although New Zealand had taken a very active lead in CRAMRA, it was very quick to join Australia and France in refusing to ratify the Convention.

Meanwhile the United Nations was debating the ability of the ATS to govern Antarctica and to effectively protect its environment. The 'Question of Antarctica' was first raised by Prime Minister of Malaysia, Dr Mahathir Bin Mohamad who suggested the United Nations should administer the area (Hayashi, 1986). The Antarctic question remained on the United Nations agenda until 2003. Malaysia acceded to the Treaty and to the Protocol in 2011 (Gilbert, 2015).

The collapse of CRAMRA, the perception that Antarctica was in imminent danger of environmental damage and the pressure from the threat of United Nations intervention influenced Treaty parties to proceed with an alternative environmental provision with, as Watts described, "commendable haste" (Watts, 1992, p. 276).

With a number of proposed solutions on the table of the ATS the third world continued to question the intention for Antarctica. "Was it a world park, a resource base, a scientific laboratory, a fishing ground, or a legacy of colonialism and imperialism?" (Dodds, 2017, p. 207)

New Zealand continued to take a proactive stance throughout the negotiations to develop a new environmental proposal be it a convention or a protocol to the Treaty. At the first of a series of Special Consultative Meetings (SCM) in Viña del Mar, November 1990, New Zealand presented a comprehensive draft protocol (Templeton, 2017) which consisted of 61 articles and included provision for an independent decision making body on matters of significant environmental impact (*Protocol to the Antarctic Treaty on Environmental Protection: draft New Zealand proposal*, 1990).

In his address to the SCM and commenting on the draft proposal Frank Wong, leader of the New Zealand delegation stated:

> Environmental issues have assumed a much greater importance in recent times. Peoples and Governments, not least in New Zealand, have come to realise that there are limits to the punishment that global, national and local environments can take. We must all act to protect and respect the planet if we are to fulfil our

> responsibilities to ourselves and to future generations...New Zealand is proud of its record in Antarctic Treaty discussions. We have traditionally been at the forefront of moves to protect the Antarctic environment. (*Interim report of the eleventh Antarctic Treaty Special Consultative Meeting*, 1990).

As a result of the negotiations the Norwegian representative drew up a new draft merging the four proposals on the table but drawing extensively on the New Zealand draft. This became the basis for future work (Templeton, 2017).

The Protocol was signed at the Madrid SCM in October 1991 and while the New Zealand delegation reported the mood as 'euphoric' they privately expressed their disappointment that it was far short of its aspirations through the draft protocol proposal, especially in the lack of an independent decision making institution and the lack of a whistle blowing role for the Committee on Environmental Protection (CEP) (Templeton, 2017). The Protocol came into force in 1998.

As there is a lack of international ability to enforce adherence to the provisions of the Protocol (Puri, 1997) the role of environmental leadership of any party must be one of modelling best practice in its own activities in Antarctica and being persuasive in influencing the best outcomes internationally.

New Zealand played an influential role in the development of the protocol. This report examines New Zealand's 'environmental leadership' since the Protocol came into force.

To quote Stuart Prior(then Head of the Antarctic Policy Unit, MFAT), "Discharging the responsibilities of our guardianship of the Ross Dependency and Antarctica for the benefit of present and future generations is an exciting, not to say breathtaking challenge." *(*Dingwell, 1998, p. IX*)*

Statutory Framework

The Protocol

Article 2 commits the parties to comprehensive protection of the Antarctic environment and dependent and associated ecosystems and designates Antarctica as a natural reserve, devoted to peace and science.

Article 3 sets out the environmental principles by which protection of the Antarctic environment, the dependent and associated ecosystems and the intrinsic value of Antarctica, including its wilderness and aesthetic values and its value as an area for the conduct of scientific research, in particular research essential to understanding the global environment shall be planned and conducted.

Article 6 describes how the Parties shall co-operate in the planning and conduct of activities in the Antarctic Treaty area.

Article 8 establishes procedures for Environmental Impact Assessments (EIAs) as set out in Annex I which describes the three stages of assessment:

- Preliminary Impact Evaluation (PEE) where an activity is determined as having less than a minor or transitory impact, in which case the activity may proceed forthwith.
- Initial Environmental Evaluation (IEE) where a proposed activity may have more than a minor or transitory impact the detail the assessment needs and if it establishes a no more than minor or transitory impact it may proceed.
- Comprehensive Environmental Evaluation (CEE) where a proposed activity is likely to have more than a minor or transitory impact.

Article 3 of this Annex details the necessary content of the CEE and sets out the requirements for public notice of the draft CEE and the period of 90 days for the receipt of comments.

Article 5 of this Annex provides for monitoring to provide a regular and verifiable record of the impacts of the activity.

The Antarctica (Environmental Protection Act) 1994 (the Act)

The New Zealand legislation that gives effect to the Protocol is the Antarctica (Environmental Protection) Act 1994. The purpose of which (clause 9) is to promote the comprehensive protection of the Antarctic environment and the value of Antarctica as an area of scientific research. The Ministry of Foreign Affairs and Trade (MFAT) is responsible for administering the Act and the final decision on any activity rests with the minister (of Foreign Affairs).

The Act applies to any person in the Ross Sea Dependency, (except members of expeditions of contracting parties and anyone who is not a New Zealand citizen or resident), any member of a New Zealand expedition or any expedition that departs for Antarctica from New Zealand, any New Zealand ship or aircraft, or any ship or aircraft that departs for Antarctica from New Zealand (clauses 3,4 & 5).

The environmental evaluations needed under the Protocol are detailed in the Act under sections 17-20 which apply to any New Zealand person carrying out any activity. If the activity is likely to have a less than minor or transitory impact the Minister may advise the applicant that the activity may be carried out although conditions may be imposed, or if it is likely to be more than minor, then a more detailed evaluation will be required, which is submitted to the parties to the protocol, the Committee on Environmental Protection under the Protocol and be publicly notified in the main cities in New Zealand for public submissions.

Method

New Zealand's performance in environmental leadership was considered in two parts. Firstly its performance under the Act and secondly its performance in environmental leadership in the CEP .

Part 1

To establish a measure of how thorough New Zealand is in applying environmental standards under the Act an analysis is done of the number of approvals issued at preliminary and initial levels.

Unfortunately time constraints of the programme prevented accessing any hard copy material from archives and therefore information sources were restricted to those available online.

The database used was that of the ATS (ats.aq) using information papers (IP) to the CEP of the annual report pursuant to Article 17. From years 2002 to 2009 these detailed all applications at both levels. For other years it was restricted to IEEs.

An understanding of the detail required and how closely that was reported on was needed to gauge any degree of thoroughness. A sample of applications and reporting against these was sourced from Antarctica New Zealand.

Using the ats.aq database a quantitative measure was obtained of all IEEs issued by country over the years since the Protocol came into force. This was used to benchmark New Zealand's use of IEEs against other countries.

To establish some degree of comparison a number of IEEs from different countries were read to ascertain the detail of environmental impact assessment required. This was necessarily restricted in most part to English versions, is subjective and at this stage only a cursory overview. Further study of this would benefit from a methodology that gave a more objective basis. IEE's were considered under two categories of science and tourism.

To complete this part a case study was done of the Scott Base wastewater system. Waste disposal is a major consideration under the Protocol and is covered under annex III. Information for this case study was sourced from Antarctic New Zealand, Ozone Technologies (D. Haselhoff, personal communication, January 21, 2018), online information and a tour of the plant.

Part 2

The second part of the study assessed New Zealand's performance in environmental leadership in the CEP by examining New Zealand's role in contributing to responses to circulation of draft CEEs and by analysing its contribution to the CEP generally.

All CEEs over the period since the Protocol came into force were retrieved from the ats.aq database. New Zealand's contribution was accessed through the working papers (WP) of the inter-sessional contact group (ICG) to the CEP which dealt with the consideration of draft CEE circulation. These were not available in all places and final CEEs were also used as a source for information on which parties submitted. The information is limited to the extent of the information available on public access portals of the ats.aq database.

Case studies were made of two of proposals that had a draft and final, or second draft, CEE. New Zealand's submissions were obtained from MFAT. These were compared with the report from the ICG to the CEP to ascertain the extent to which New Zealand concerns or recommendations were reflected. A comparison was then made between draft and final (or draft and 2nd draft) to ascertain the extent of influence on outcome.

It must be remembered that influence is the only means of changing any potential outcome as the decision making as to whether or not an activity proceeds in Antarctica remains with the proposing party and there is no mechanism under the Protocol to enforce international adherence to its provisions.

A quantitative measure was made of New Zealand's contribution to the CEP by using a methodology established by Dudeney & Walton (2012) who examined the different parties' contribution to science papers to the Antarctic Treaty Consultative Meetings (ATCM). The number of WPs contributed by New Zealand is compared with that from other parties, with a formula used by Dudeney & Walton for attributing a value to shared papers. This is detailed under the relevant section. The results are also normalized against GDP using, as they did, the World Bank figures.

Performance under Antarctica (Environmental Protection) Act 1994

Role of the Ministry for Foreign Affairs and Trade

MFAT is the government agency responsible for New Zealand's overall interests in Antarctica and the Southern Ocean. They represent New Zealand's interests in the ATS, conduct relations with other countries in respect to Antarctica and provide policy advice on Antarctica. They handle all applications for activities under the Act. The Minister issues all decisions on preliminary and initial EIAs. MFAT receives all compliance reports on the EIAs.

Role of Antarctica New Zealand

Antarctica New Zealand is the Crown Entity that manages Scott Base and is responsible for activities in Antarctica and the Southern Ocean such as scientific research, conservation, and public awareness. They prepare the IEE for the operation of Scott Base and the National Antarctic Programme and work with scientists and other organisations on preparation of a preliminary environmental evaluation for all field events they support and may be asked by MFAT to comment on those from other parties such as tourism industry. They lead the process in preparing New Zealand's comments to the CEP on international CEEs.

Number of EIA applications since Protocol came into force (1998)

Table 1 showing number IEE granted by activity; number declined; number of PEE

	Non-Science	MPAs SPAs	Science	Tourism Ross Sea	Tourism other	Fishery	NGO	Operation /logistics	Heritage	**Total granted**	Total declined *	PEE **
1999			2	1	2	7	1			**13**		
2000			2	5		3				**10**		
2001			2	1	3	3				**9**		
2002				2				1		**3**		57
2003			1	2	1					**4**		74
2004			3	2					1	**6**		47
2005			1	2						**3**		70
2006			2	4	3			2		**11**	2	74
2007				3						**3**	2	75
2008			1	2				1	1	**5**	3	45
2009			2	6		2		2	1	**13**		
2010	1		2	4			1	1	1	**10**		
2011		2	2	3			2	3	3	**15**		
2012	1		1	3				3	2	**10**		
2013	1		1	2	1			2	1	**8**		
2014	1			2			1	1	1	**6**		
2015	1		1	2	1			1	1	**7**		
2016	1	1	1	1				1	2	**7**		
2017				1	1			1		**3**		

* Those declined were for tourism to ASPAs & to other parts of Antarctica, and 2 were for environmental NGOs.

** The figures for PEEs are limited as they were not able to be accessed for the other years than those shown.

Monitoring of Compliance

In issuing a notification of approval the Act allows the Minister to impose conditions on the activity and generally these include compliance monitoring. The compliance reports are not generally publically available.

All tourist ships are required to carry an observer, usually from the Department of Conservation. It is the role of this observer to report on compliance with the IEE and this report is shared with the operator. All operators are required to submit a post visit report. There is only one operator consistently providing a service from New Zealand and that is Heritage Expeditions. Their report covers details of landings. They do not have any issues with non-compliances as the MFAT representative has the ability to make on the spot decision and ensure that compliance is achieved (N. Russ, personal communication, January 29, 2018).

An analysis of Antarctic New Zealand Annual Reports show that from 2012/13 onwards they have reported against a performance measure that 'Antarctica New Zealand fully complies with the terms of its own Environmental Impact Assessment and permit issued under the Antarctica (Environmental Protection) Act 1994'. The report for 2012/2013 recorded 1 minor infringement (non-permitted entry to an ASPA) and 10 minor incidents over 5 events and the 2014/15 report records 2 minor non-compliances of guiding NZ Defence Force

personnel through the Discovery Hut (outside terms of permit) and staff assisting a science team.

In the preceding years from 2000-2001 there were, in most reports, a measure on environmental performance that covered EIAs and there were no non-compliances reported.

Antarctic New Zealand's final environment performance report to MFAT on the 5 year notification/permit, however, shows more detail. The number of non-compliance issues among field events supported by Antarctica New Zealand has decreased over a twenty year period in spite of an increase in the number of events. The majority of non-compliances are reported as being minor in nature resulting in less than minor or transitory impact. They cover such incidents as collection of snow samples not covered in a permit. Other incidents include: non-permitted ASPA entry, use or over use of approved chemicals, unapproved or over sampling (flora, fauna and physical samples), unapproved installation of equipment, and loss of equipment. The number of events for this period increased from 60 to 100.

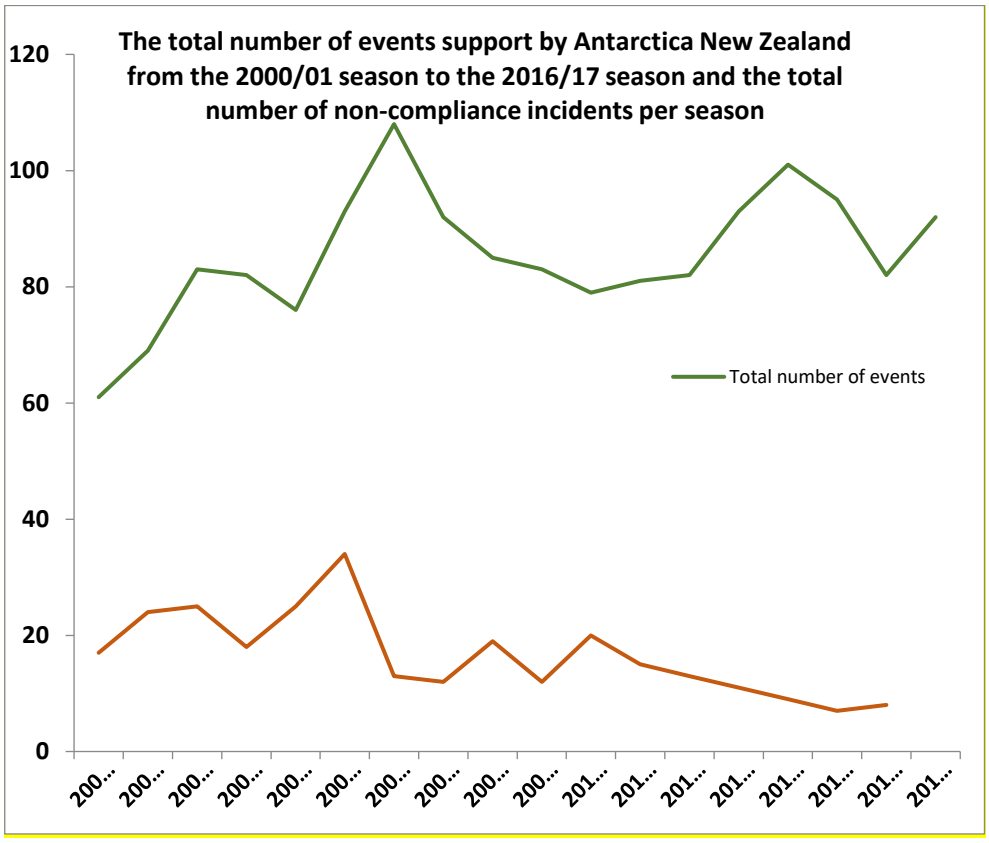


Figure 1 Summary of environmental non-compliances from events supported by Antarctica New Zealand from 2000/2001 to the 2015/16 seasons. (Source Antarctic New Zealand)

The number of fuel/chemical spills has increased over from the 1998/99 season to 2014/15 from 2 to 15 with a peak of 20. But contrasted with that is the decrease in amount spilt with one large fuel spill in 1999/2000. This was estimated at 1,500 litres from an old fuel line which was replaced. In most seasons the fuel/chemical spill is less than 100 litres and is mainly from the Scott Base operational area. It includes such occurrences as flaked paint from the yellow field kitchen boxes and from fuel drums.

It is worth noting the detail that is given to cleaning up paint contaminated ice. In the case of the fuel drums the paint contaminated ice was contained within bunding, and later chipped out, melted, separated and the paint flakes put in the waste and returned to New Zealand.

There are a number of incidents of non-native species incursions which mainly occur with the food imports especially dried food products. Any pest contaminated food is sealed, frozen and returned to New Zealand for disposal. There are also a number of reports of seed and plant material transported by clothing or equipment. The increase in reporting is considered to be a function of the increased awareness of personnel allowing proactive measures to be undertaken to remedy the situation.

Benchmarking against other Countries

To benchmark New Zealand's performance against other parties of the Treaty a comparative study was made of the number of IEEs submitted and approved. This is reported each year and is retrievable from the Antarctic Treaty website.

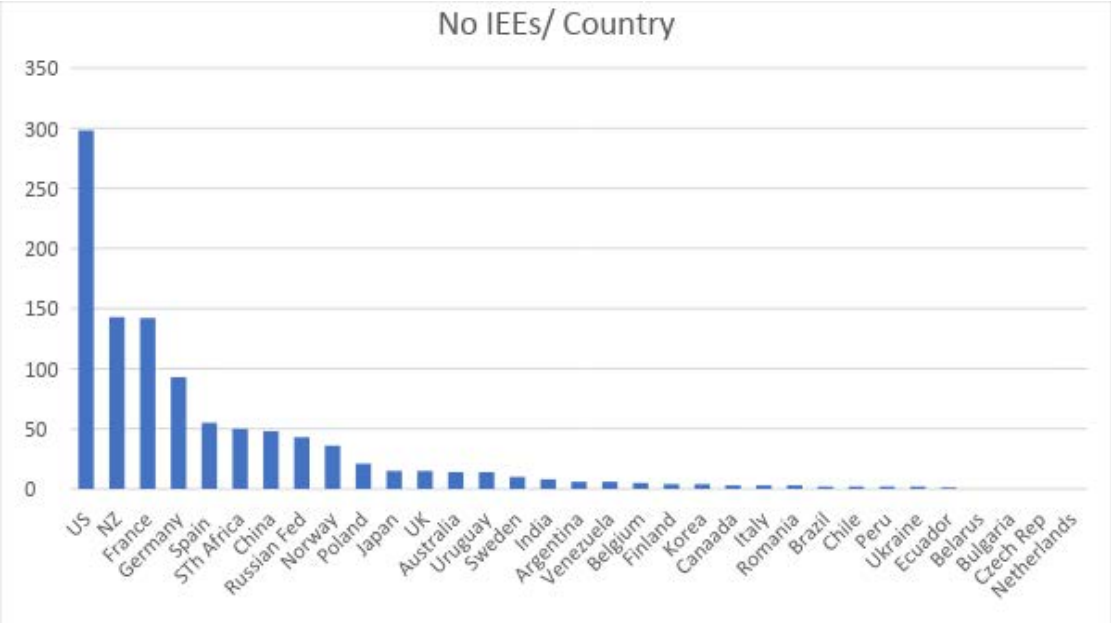


Figure 2 Comparison of number of IEEs submitted and approved 1999-2017

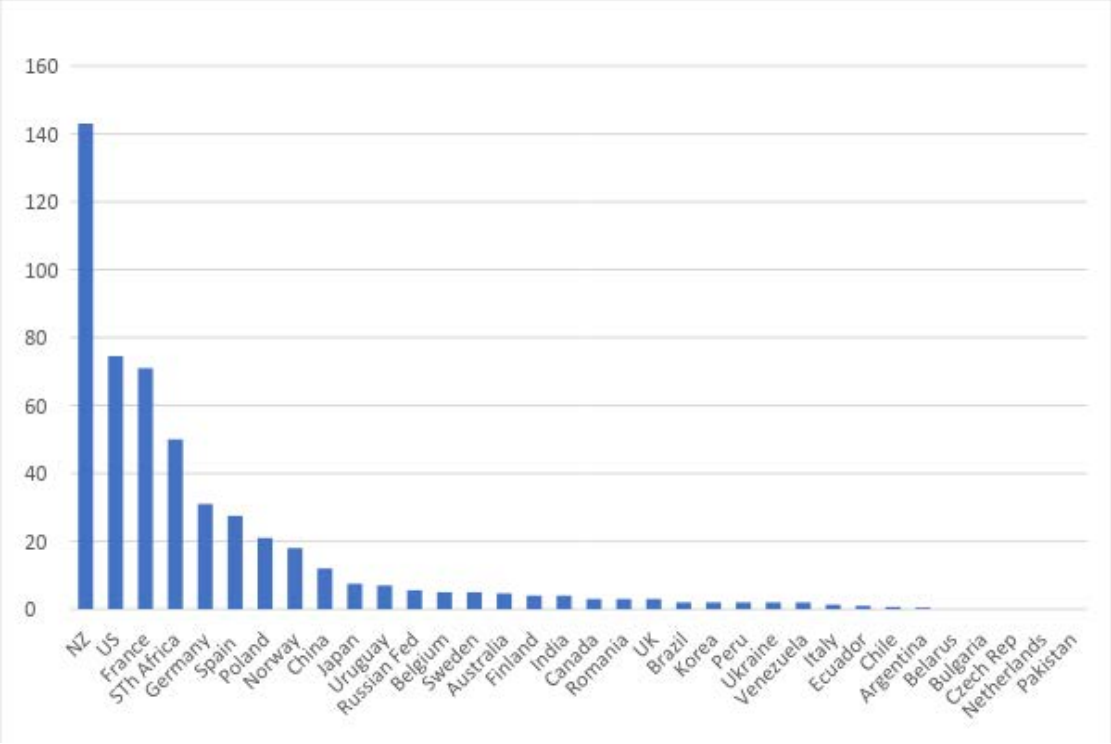


Figure 3 Comparison of number of IEEs submitted and approved 1999-2017 divided by the number of bases per country

A number of the IEEs were compared for the level of detail presented in the IEE. This was a cursory view only, as many of the IEEs are not attached to the decision, and no methodology was established to compare like with like as to the potential impact of the event.

IEEs from New Zealand, Australia, China, France, United Kingdom and United States, all for science related events, were considered. On the whole, although some had a lot of detail on the proposal and the reasons for the proposal, the environmental impacts were addressed in a very limited way. New Zealand appears to require far more detail on the potential environmental impacts for these assessments and to require them over a greater number and range of events than any other country.

The corollary of the detail required also indicates the ability to monitor impacts against this to a greater degree. Without examining this further and being able to establish the level of activity as a comparable level against other like events on other stations it is not possible to infer greater effectiveness. It is, though, an indication of the thoroughness with which New Zealand applies its responsibilities under the Act.

The situation is different, however, with the detail in the IEE for tourism where there is far more commonality between countries. IEEs from New Zealand, France, Canada, the United States and Argentina were compared. The International Association of Antarctic Tour Operators (IAATO), a non-governmental organisation (NGO) with invited expert status at ATCM, has developed guidelines for its members which appear to set a more uniform approach across countries. This was not, however, examined in any detail.

Concerns have been raised that the MFAT requirements for tour operators are overly demanding and that a number of operators previously departing from New Zealand are now choosing to operate out of Australia (N. Russ, personal communication, January 29, 2018).

Antarctica plays an important part of the New Zealand economy contributing in total impact $431.5m in 2016 of which 35% is from tourism. It must be noted that the bulk of this is from Antarctic related tourism in Christchurch (Saunders, 2016).

Case Study Scott Base Wastewater

Annex III of the Protocol sets the standard that wastewater treatment must meet. In many cases this is less than the national standard applicable in the base's country.

Article 1 of the annex gives an overarching principle for all waste. The amount of waste produced or disposed of in the Antarctic Treaty area shall be reduced as far as practicable to minimise impact on the Antarctic environment and to minimise interference with the natural values of Antarctica, with scientific research and with other uses of Antarctica which are consistent with the Antarctic Treaty.

Article 2 refers to sewage and domestic liquid wastes (grey water) and states that they shall to the maximum extent practicable, be removed from the Antarctic Treaty area by the generator of such wastes.

Article 4 deals with the impracticable removal (for inland stations) by allowing sewage, domestic liquid wastes and other liquid wastes to be disposed to deep ice pits.

Article 5 allows sewage and domestic liquid wastes to be discharged directly into the sea, taking into account the assimilative capacity of the receiving marine environment.

In 2009 17 stations in Antarctica were discharging untreated sewage to the environment, and of these 6 were discharging the raw non macerated sewage to sea. (Tarasenko, 2009)

Wastewater treatment in Antarctica poses a number of challenges. The extreme climate limits the type of treatment options. Geographic isolation not only adds cost to installation and servicing but means for long periods of the year there is no access for any expert help or spare parts if there is a malfunction. High technology specifications can be inappropriate under these circumstances. Consequently the most suitable plant must be simple to operate and as near to fail safe as can be achieved.

Scott Base installed its wastewater treatment plant in 2002. The treatment is by maceration which occurs at each of the toilet blocks, clarification and an aerated biological treatment using fixed medium of plastic mesh. There are 6 chambers and they can work independently. They can be aerobic, anaerobic or facultative but currently all run as aerobic. In winter not all chambers are used. The advantage of maceration at each toilet block enables a toilet block to be shut down if maceration fails, ensuring continuing performance of the wastewater treatment. This is in contrast to the McMurdo Base where maceration occurs at the plant. Failure at this point can lead to a compliance problem.

Wastewater Treatment Plant at Scott Base (building to left)

This system was chosen over alternatives for its ability to meet the specific treatment standards, a conservative design, simple to operate and to be operated by non-specialist staff, low maintenance and a compact footprint. It met the requirements of best practice in Antarctica and New Zealand and met New Zealand cultural and aesthetic considerations.

The performance requirements for the new plant were <30m/l BOD and SS and <200 cfu/100ml faecal coliforms. The effluent must, after dispersal, provide a seawater quality suitable for human consumption of shellfish (*A new wastewater treatment system for New Zealand's Scott Base*).

One of the challenges is in controlling the dissolved oxygen. The system is also tested by wastewater from the labs and from field trips. Urine can be weeks old in field and is high in ammonia. At the time it was built Scott Base produced 17,000 litres wastewater/day (including greywater). The system is designed to run to run at an optimum of 160 litres/person/day of water, but the reverse osmosis plant is limited in the amount of fresh water produced and water is therefore restricted resulting in lower use of about 120 litres/day. This also can result in higher levels of ammonia.

The waste settles out and is dewatered weekly and the solids are bagged and returned to New Zealand. Currently there is no drying facility and provision for drying would reduce weight of waste material for transport. The grease trap needs a 12 hour bypass weekly for cleaning and an upgrade to avoid this could improve performance.

Wastewater treatment clarifiers and chambers

Originally disinfection was by ultraviolet light treatment but this was replaced in 2007 by ozone treatment. This is effective in removing endocrine disrupters including contraceptives.

At the time it was installed it was reported in a case study as exceeding requirements of the Protocol (*Containerised wastewater treatment package*).

An audit of the wastewater plant was conducted in October 2017. The plant was found to be clean and well maintained. There were problems with low oxygen levels in the first chamber but relatively healthy biota in remaining chambers. Monthly monitoring showed generally low faecal bacteria levels, turbidity and COD (chemical oxygen demand) except for start-up in October. The report recommended seeking expert solution to the problem of the effect of rapid changes in base population on the waste water quality. (Webster-Brown 2018)

Generally the wastewater plant is fit for purpose and performs well. But big fluctuations in population of Scott Base need to be managed in the running of the plant.

Performance Internationally under the Protocol
New Zealand's Contribution to Consideration of CEEs

Table 2 Number of countries submitting on CEEs

Country	Draft	Final	Activity	NZ submission	No. Countries submitting	No. CEP members
Italy	2016	2017	Construction gravel runway Terra Nova Bay by Italian Station	Y	9	37
Belarus	2015	2013	Construction & operation new Station in Enderby Land	Y	10	35
China	2013		Construction & operation new Station Inexpressible Is.	Y	12	35
UK	2010	2011	Direct measurement & sampling Subglacial Lake Ellesmere	N	9	34
India	2006	2010	Construction & operation new Station Larsemann Hills	Y	4	34
Korea	2003	2010	Construction & operation new Station Terra Nova bay	Y	7	34
Russia		2010	Direct measurement & sampling Subglacial Lake Vostok	Y	5	34
China	2007	2008	Construction & operation new Station (Kunlun) Dome A	Y	10	32
Belgium	2006	2007	Construction & operation new Station Dronning Maud Land	N	2	32
NZ	2002	2008	Climatology: ANDRILL drilling programme McMurdo Sound	n/a	7	32
Ukraine	2006		Construction new fuel tanks Vernadsky Station	No inform.		32
Germany	2004	2005	Construction & operation rebuild Neumayer III Station	No inform.		32
Norway	2003	2004	Station upgrade, Troll, Dronning Maud Land	N	2	32
UK	2004	2006	Construction & operation Halley VI Station	Y	4	32
US	2004	2004	Construction & Operation South Pole Traverse	No inform.		32
US	2004	2004	Science: Astronomy- Project Ice Cube neutrino telescope	No inform.		31
Czech Rep.	2003	2003	Construction & operation station James Ross Is.	Y	2	29
Russia		2002	Science: Climatology -water sampling Lake Vostok	Y	5	29
Germany	1999	2000	Ice Drilling -European (EPICA) Project, Dronning Maud Land	Y	9	28

Countries regularly submitting on the draft CEEs are Australia, France, Germany, New Zealand, Norway United Kingdom and United States. Occasional contributors are Korea, Japan & South Africa while Belgium, Ecuador, Russia and India have contributed once.

Two Case Studies

All draft CEEs must be circulated to all parties and in each member country be publicly notified. The process for public notification in New Zealand is set out in the Act (s19) as publishing a notice in the daily newspaper in each of the cities of Auckland, Wellington, Christchurch and Dunedin, and that the closing date for comments is 90 days after the date of publication. This timeline is taken from the Protocol.

The procedure followed is to advertise once, but to circulate the information to stakeholders such as Gateway Antarctica, the Universities and Environmental NGOs. There is usually follow up communication after 60 days.

Unfortunately figures on public response over all CEEs are not available but for the two case studies that follow there were no submissions on the Italian Terra Nova Bay gravel runway proposal and only two on the Chinese Inexpressible Island station proposal.

While all submissions are acknowledged no feedback is given to the person or organisation making comment.

Antarctic New Zealand leads the Government response and can call upon suitably qualified experts for input. The timing of the official response and the public process does not always coincide. As the Protocol requires circulation to the CEP only 120 days before the next consultative meeting and within that time an Intersessional Contact group (ICG) must consider and write a report on the comments the official comment is often submitted before the closing period for public response.

This timing, precluding consideration of public responses in the official comment, occurred in both the cases studied. In the case of the Chinese proposal the public comments were sent directly to the proposing Party. Where time allows the public responses are taken into account in the official comment.

Chinese Proposal for new station on Inexpressible Island

In 2014 China circulated a draft CEE (China, 2014) on its proposed construction of a new base in Victoria Land housing 80 summer staff and 30 over winter. The site chosen was on the south east coast of Inexpressible Island for the expressed purpose of providing a base for research on the following topics: - atmosphere-ice-ocean interaction studies; glacial and ice-shelf ocean interaction; environment and ecosystem monitoring; space physics studies; geological environment evaluation studies.

It is no secret, however, that China has declared, within its own national communications, its interest in mineral exploitation. A 2013 report from the China Arctic and Antarctic Administration (CAA) Polar Strategy Research Trends outlines the importance of Antarctica's mineral resources to China while the CAA head described the identified location for the new base as "one of the hottest locations in Antarctica" (Brady, 2017).

The new station was to be sited within a short distance but over a low ridge from a Adelie penguin colony and an Historic Monument and Site (HMS) listed as a protected area. There are some shallow 'lakes' in the area and these have been referred to as a potential source of water for the station.

New Zealand commented on the generic nature of the science identified and requested more information on the proposed research noting that it be helpful to have a context of the existing research in the region with an indication as to how the new facility would be complementary.

In summary, the points covered in the comment were that the CEE would benefit from: an enhanced consideration of alternatives; exploring opportunities for sharing facilities or placing the location of a station within a firmer scientific context; detailed information on the reference state of flora and fauna, noting that if water was to be taken from the lakes for station use then the ecology of the lakes should be provided; detailed information on soil invertebrates and microfauna noting that Inexpressible Island has been found to have the greatest diversity of soil algae in northern Victoria Land; near shore environment assessment; colony mapping and bird counts of penguins and skuas. The need for scientific referencing with appropriate literature citation was noted.

The comment also queried the proximity to the site of Scott's (Terra Nova expedition) Northern Party's ice cave site (HSM14), scene of one of the most remarkable survival stories of the heroic age, and the impact the station would have on this site.

New Zealand also noted the inadequacy of the consideration of cumulative impacts noting that China should address the combined impact of all the stations noting especially cumulative loss of ice-free ground.

A more explicit monitoring programme was requested linking it the initial reference state and the impacts of the construction and operation of the station.

MFAT received two comments from the public but these were not received in time for the ICG and were sent directly to the Chinese contacts. While they may not have been able to influence the New Zealand position on this first draft, one of them covered very similar concerns (P. Broady, personal communication, January 16, 2018).

Comments were submitted to the ICG by Australia, France, Germany, New Zealand, Norway, South Africa, the United Kingdom, the United States and by an NGO with invited expert status, Antarctic and Southern Ocean Coalition (ASOC). The ICG report (United States, 2014) covers all the main points raised by New Zealand noting the need to detail the scientific programme to demonstrate that it is unique rather than duplicative to justify the conclusion that the benefits outweighed the impacts and recommended either sharing facilities or a smaller building.

The lack of information on the initial environmental reference state was seen as a hindrance to properly assess the impacts and detailed site surveys, including soil communities, ice-free areas, near shore environments and bird populations, with a thorough literature search was recommended. Further information was sought on the relationship to the historic sites,

HMS 14 (ice cave) and HMS 68 (Hell's Gate Moraine depot) and impact on those sites as well as the position of some of the ancillary building and structure such as the solar panels and wind farm.

In January 2018 China circulated a second draft CEE (China, 2018) for further comments. Since the 2014 draft CEE China has made two studies on the initial reference state of Inexpressible Island in the austral summers of 20014-15 and 2017, identifying 1 moss and 8 lichen, of which they give brief details with illustrations and details of the global frequency of each species and a brief literature search. But there is no mention of the terrestrial microfauna, nor any information on the freshwater community of the ponds from which they proposed taking water, nor the near shore community. They have identified the number of breeding pairs of Adelie penguins and skuas but the fauna study is restricted to penguins, skuas and Weddell seals.

The revised draft CEE states "Our previous investigations on the Inexpressible Island conclude that the terrestrial ecosystem there is quite simple. The lichen community is rarely seen, there have several lakes which are measured to be shallow and totally frozen during the winter. So currently we don't consider the study of the terrestrial ecosystem as of a major research project" (China, 2018) and then suggest that New Zealand is welcome to participate in their study.

This disregard for the terrestrial faunal and floral communities is of great concern to Dr P. Broady (personal communication January 16, 2018) who did submit on the original draft. He described the uniqueness of the terrestrial flora on Inexpressible island outlining its role in the harsher environment where microflora takes on a more important role than that found in other ice free areas of Terra Nova Bay. He also raised concern at the lack of information on other biota of microfauna questioning whether they also could have unusual communities.

He outlined in his submission the requirements of an adequate assessment of the terrestrial ecosystem as a full survey of all the terrestrial biota on Inexpressible Island, a comparison with other ice-free areas in the Terra Nova Bay region and a broader comparison with other Antarctic regions to enable a rational assessment of the potential impact of a large research station. He pointed out that differences are found between habitats at a single locality, between localities in the region, and between different regions. Dr Broady referred to his own studies, and those of other scientists, on Inexpressible Island which have shown the terrestrial vegetation to be abundant, diverse and very different from other locations in Terra Nova Bay.

He explained how Antarctica, unlike other continents, is dominated by microbial communities which cannot be revealed by visual inspection but which require techniques such as microscopy, cultures and molecular genetic study to understand the extent and diversity of the ecosystem.

The revised draft CEE still does not suggest a science strategy that supports the findings that the benefits outweigh the impacts. There is no development on their generic categories from first draft except for a suggestion on a co-operative development for a monitoring strategy for the new Ross Sea Marine Protected Area. China did, however, visit all occupied

neighbouring bases in the Ross sea area (Scott, McMurdo, Mario Zucchelli and Jang Bogo) to discuss their national programmes , potential logistics co-operation and collaboration.

The biggest change in the drafts is the repositioning of the station a further 2 km south on Inexpressible Island and a change in design that reduces the footprint of the actual base. The reasons for doing so appear largely logistic although the comment that the site was chosen for biological sensitivity and considering the potential environmental impact does suggest some influence from the input of the ICG.

The Topography of the new site. Reproduced from the Chinese CEE

New Zealand did comment on the first draft that the reasons for selecting the option chosen were based on logistical and operational considerations rather than fulfilling scientific objectives, and although the revised draft does state the selected site of the station must have outstanding significance for research it does not elaborate how it meets that criterion.

Although the actual station footprint has been reduced a comment on base expansion describes a 1-2 square kilometre area including hilly highlands northeast and northwest with observation rooms, facilities, satellite ground stations, wind farm, and shelters, all of which suggest a significant footprint on the island impacting on the aesthetic and wilderness values of the historic sites. The ICG report had raised the issue of where the wind farm would be sited, and this expanded list of outlying structures still gives nothing more than a general location NE & NW.

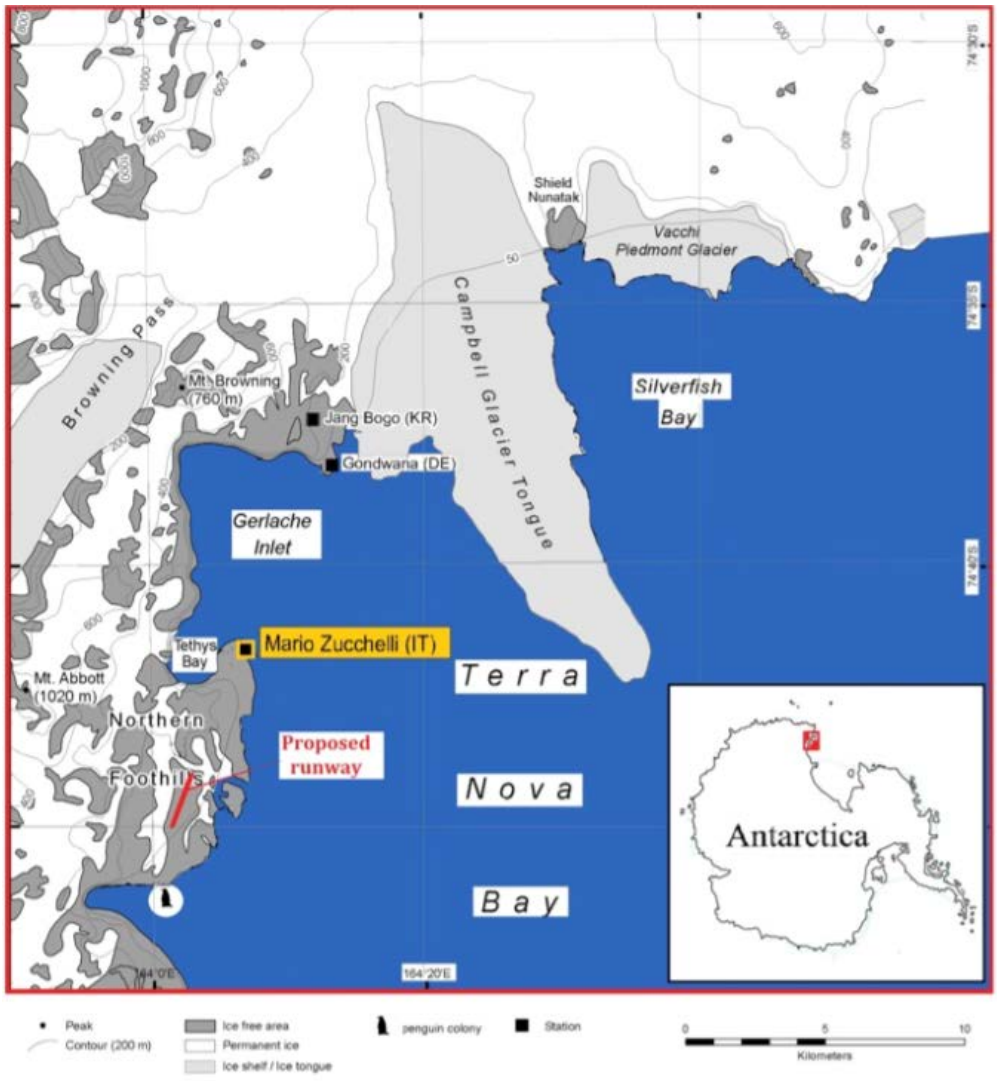
Inexpressible Island is a permitted landing area under Heritage Expeditions permit, and may be under permits issued by other states, with the focus of visits being the historic site and the penguin colony. But as Dr Broady (personal communication, January 16, 2018) pointed out other than the accidental overwintering of Scott's northern party, so far access has been limited to a few hours per day or a few days. The impact of decades of 80 people living, working and traversing the area on foot and in vehicles to access the many outlying structures is going to be significant. He found it ironic that China suggested an ASPA in the vicinity of the penguin colony but did not addressed the issue of a potentially extensive

impact on the terrestrial micro communities. No baseline measurement of terrestrial microfauna & flora has been done on the new site, and those potential impacts remain problematical.

One other matter raised by New Zealand and in comment from ICG is on the need for detail on the 'emerging technology' of the magnetic pyrolysis furnace. Wastewater management is a continuing challenge for all stations and more effective treatment options are continually sought. China does not provide any further detail in this draft and so far in New Zealand no industrial scale pyrolysis has been successful.

Italian Proposal for runway Terra Nova Bay

In January 2016, Italy circulated a draft CEE for the proposed construction and operation of a gravel runway in the area of Mario Zucchelli Station, Terra Nova Bay, Victoria Land, Antarctica (ENEA, 2016). The runway was proposed as a long-term solution to the problems experienced with unreliability of the sea ice runway used to transport personnel and materials from Italy to Mario Zucchelli Station.



Map of Terra Nova Bay showing site of proposed runway and position of the Italian and neighbouring stations. Reproduced from the Italian CEE.

The proposed site is on the Northern foothills, 6 kilometres south of the station and will be linked to it by a 4 kilometre extension to an existing road to the Enigma Lake skiway. The runway will be built on an ice-free area of moraine overlying glacial ice. The construction will result in the loss of significant terrestrial ecosystems and is relatively close but above an Adelie penguin colony. It will cause the loss of 50% of the circumpolar active layer monitoring (CALM) site established in 1999 as part of a network of long term monitoring of climate, permafrost, active layer and vegetation in Victoria Land.

Italy has suggested the runway will be able to service nearby Jang Bogo Station (Republic of Korea), Gondwana (Germany) and the proposed Chinese base on Inexpressible Island as well as being an alternative long-distance landing site for McMurdo in case of inclement weather. Comments were submitted by Australia, China, Republic of Korea, France, Germany, New Zealand, Norway, the United Kingdom and the United States, as well as from ASOC. There were no public submissions from New Zealand.

New Zealand's comment on the draft CEE covered a range of recommendations but particularly focused concern at the lack of information and assessment of impact on the invertebrate microfauna and sought further information on the novel mitigation proposal of transplantation of vegetation requesting identification of transplant sites and the impact on the microfauna that would inevitably be transplanted with the flora.

They were also concerned that information on the actual impact on the science of the loss of 50% of the CALM monitoring site was not covered and questioned the novelty of the proposed mitigation of transplantation of the microflora suggesting that information on other cold climate areas and literature references on where this has been successfully achieved would be helpful.

The New Zealand comment expressed concern on the lack of cumulative impact assessment, especially important considering the already circulated proposal of a new Chinese base in the near vicinity and cited in particular the potential cumulative effects of the loss of a yet further ice-free ecosystem.

They recommended climate modelling to inform the impact of climate change on glacier stability which may shorten the life of the runway, and they suggested that although it may not be something that can be mitigated, the explicit recognition of the impact of the runway and road on aesthetic and wilderness values should be included for completeness of impact assessment.

All these points were covered in the ICG report (France, 2016) to the CEP and, on the whole, addressed by Italy in the final CEE albeit probably not to the extent suggested. There is still a lack of detail on the terrestrial ecosystem of both microflora and microfauna with no consideration of the microbial community.

In the final CEE it is asserted that "Literature provides examples of transplantations" (ENEA, 2017, p. 159) but whether or not such examples are relevant to the harsh Antarctic conditions is not known as there are no citations nor is there any relevant publication in the references. The final CEE does, however, detail the sites identified as reception areas. Dr Broady (personal communication, January 16, 2018) questioned the rationale for replanting in

existing areas of currently sparse population as it overlooks any reason for that sparsity, which may impact on the success of any transplantation.

Perhaps the most articulated response to the comments is on the loss of a substantial portion of a long-term monitoring site. The CALM grid, established in 1999, is the longest near-continuous data series of permafrost and active layer temperature in Antarctica. The data collected so far shows that ecosystem changes occur rapidly and are detectable after only 10 years (Guglielmin, Fratte & Cannone 2014).

After consultation with the scientists involved (part of the Italian National Antarctic Programme) the mitigation will be a replication of the area due to be lost by an equivalent area with 1-2 years of undisturbed comparable data; to add webcams to monitor year-round areal snow variations; and to fit thermistors into shallow bores which will help understand the impact of the runway on the remnant grid.

Concerns over the cumulative impacts were addressed by a section on what defined cumulative impacts and their importance without actually addressing the impacts. A brief description on the relative size and distance of the neighbouring bases indicated they did not overlap. No reference was made to the cumulative loss of ice-free terrestrial ecosystems by the impact of the number of bases in the area plus the runway.

The other oversight is on the longevity of the runway should climate change impact the stability of the underlying ice which was not addressed in the final CEE, nor was the estimate of total use of other neighbouring stations using the runway.

New Zealand was generally supportive of the proposal making the comment that the logistical requirement for a gravel runway to support ongoing scientific operations in the area was well made in the document.

New Zealand's Contribution to Committee on Environmental Protection

A quantitative analysis of all parties' contribution to the CEP was made by replicating the methodology of Dudeney & Walton (2012). For the purpose of this study papers from the Scientific Committee on Antarctic research (SCAR), Council of Managers of National Antarctic Programs (COMNAP), Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) and NGOs were excluded. While WPs (which are debated in session) and IPs (for information only or only debated on request) were counted for completeness the comparison of the ratio of one to the other was not relevant to this paper.
The important figure to consider is the number working papers as they do carry greater weight demonstrating engagement in the ATS (Dudeney & Walton, 2012, p. 3)

WPs and IPs submitted by a single party were given a score of 1. Where there were 2 parties they were given a score of 0.5 each. Where there were multiple parties the first named was given a score of 0.5 and the remaining parties were scored by the formula $x= 0.5/(n-1)$ where x is the score and n the number of parties contributing.

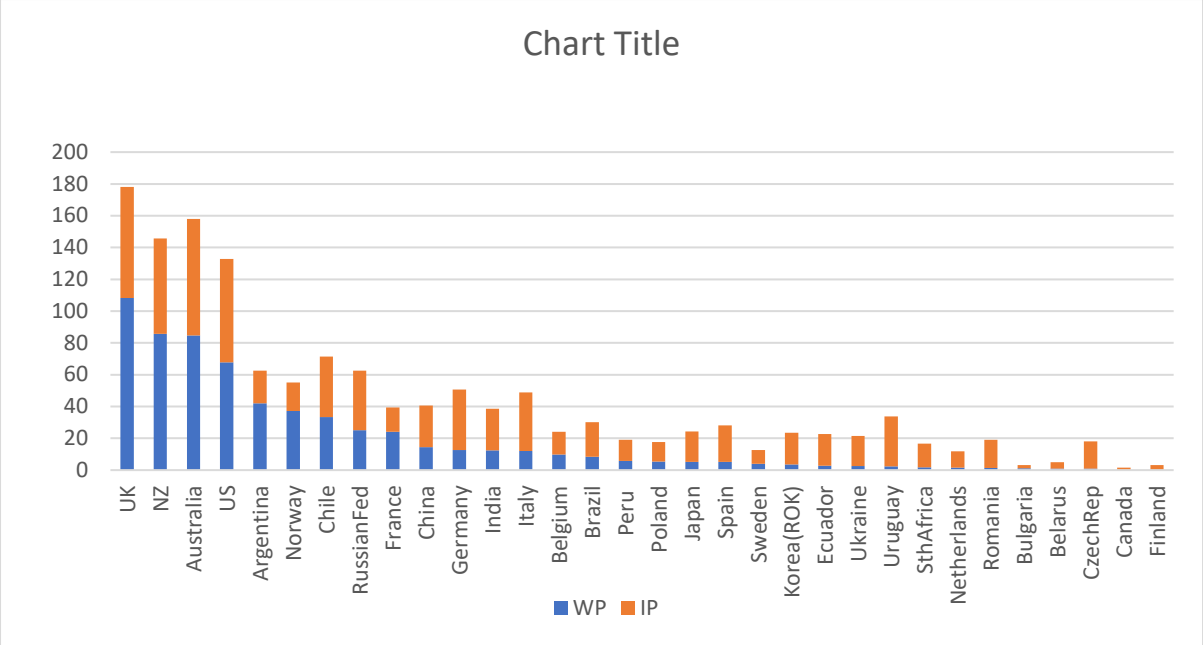


Figure 4 Showing the number of working papers and information papers submitted to CEP meetings for the period 1999 to 2017

This is a very similar pattern to that found by Dudeney and Walton which, for comparison is reproduced below. While there are some variations in order the top three, referred to as the 'Imperial 3', remain in top position.

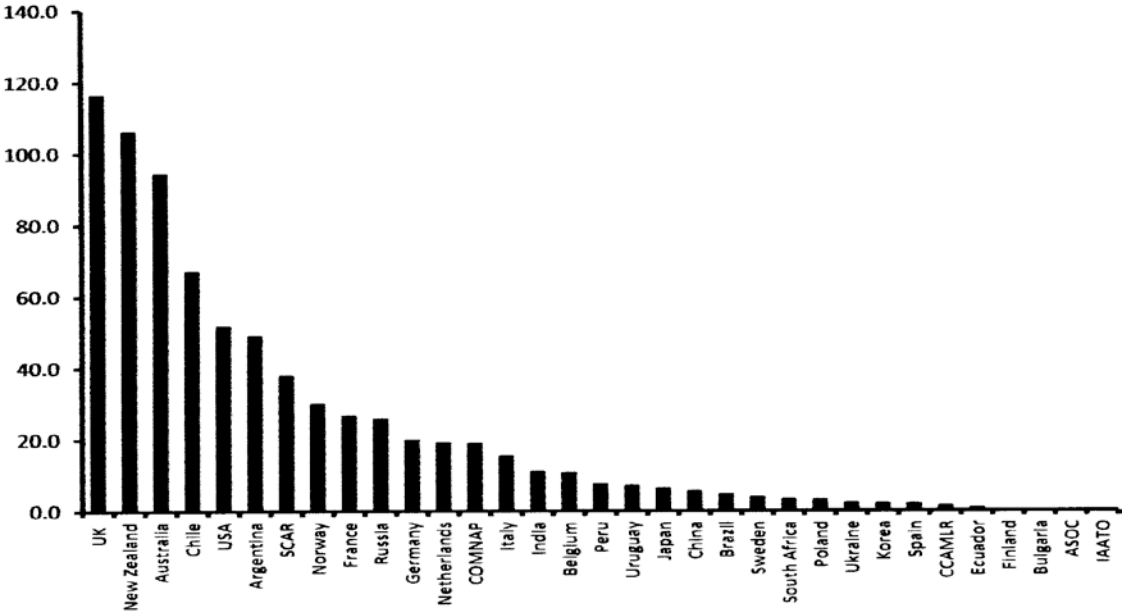


Figure 5 Total sum of Working Papers produced by each of the Parties to the Antarctic Treaty for the period 1992- 2010, ordered by descending total number from the left-hand side of the plot. Reproduced from Dudeney & Walton (Dudeney & Walton, 2012, p. 5)

The number of WPs per country was then normalised by the GDP using the World Bank figures for 2017. No attempt was made to adjust for varied growth in GDP over the period studied as that was not done in the previous study. The y axis is an adjusted value obtained by dividing the number of each country's WP by that countries GDP in $US reduced by a factor of 10 to the 18th power.

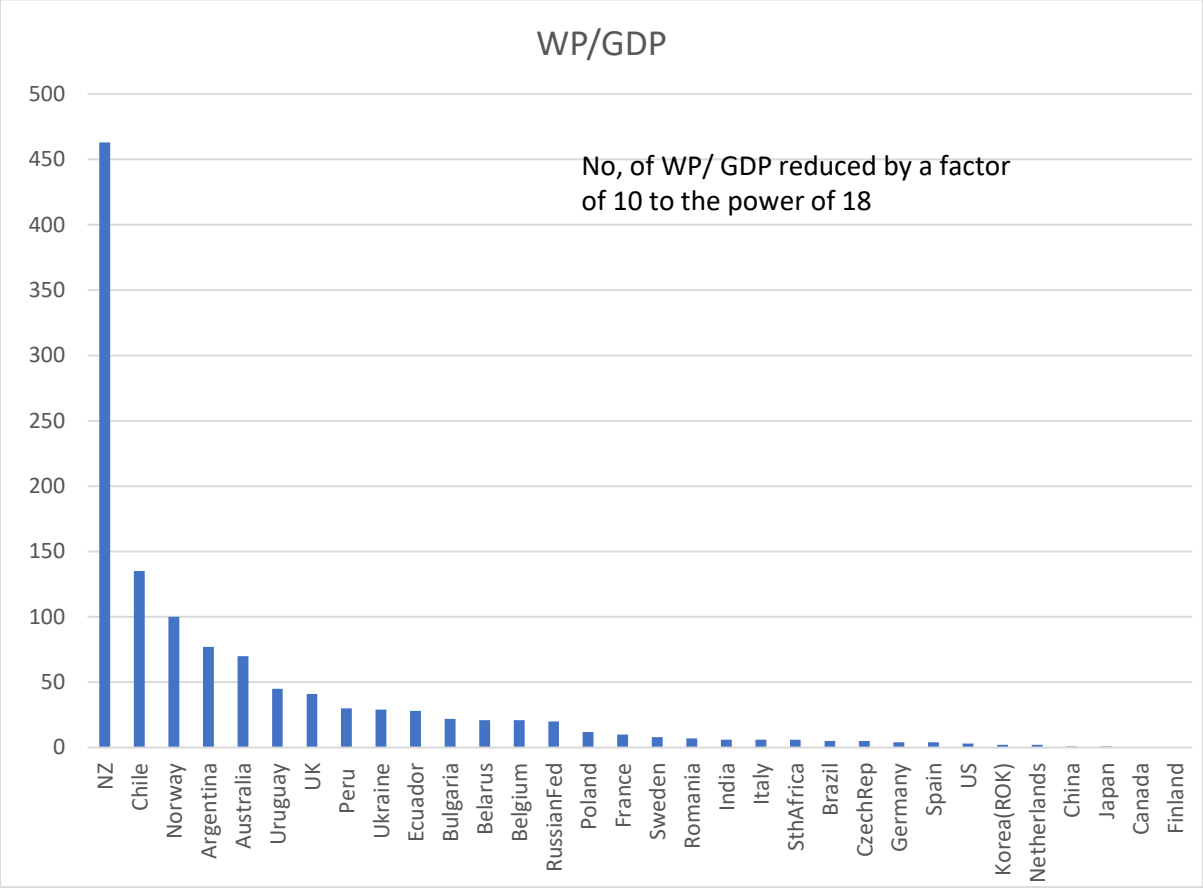


Fig. 6 Again there is a marked correlation between this result and that found by Dudeney and Walton. While there were some minor changes in order the same countries remained at the bottom. The number of countries with membership on the CEP increased from 28 in 1999 to 37 in 2017.

Discussion

A number of parameters have been considered in assessing New Zealand's performance in environmental leadership.

The consideration of the reporting on the number of IEEs issued by New Zealand, and the benchmarking of that against other countries suggests New Zealand demonstrates leadership in the attention paid to assessing potential impacts.

New Zealand receives and assesses more IEEs than any country other than the US. When this figure is divided by the number of bases the result shows New Zealand far ahead of any

other country. This does not take into account the relative size of the base in terms of personnel and number of science events.

These figures are based on availability of data through the public portal of ats.aq and the accuracy of reporting has not been verified. But as the majority of countries do supply figures to the ATS the result is unlikely to be sufficiently inaccurate to skew results.

Therefore it is reasonable to conclude that New Zealand is far more particular in requiring this level of environmental impact assessment than any other country other than the United States.

Requiring such an assessment is only the starting point. To what extent that translates into good practice is another matter.

In Antarctic New Zealand's reports to MFAT, the degree of reporting against non-compliance is detailed. All non-compliances are recorded as is the remedial action. Results for any non-compliance for events is plotted over the period 2001-2017 showing a considerable increase in events but a decrease in incidents. The conclusion in the last 5 year report is that the impact of the incidents is less than minor or transitory.

What response is made back to Antarctica New Zealand by MFAT is unknown but there is a pattern in the comments both in the annual reports and in the compliance reports to MFAT of continuing pursuit of best practice, and the ability to use the information gained to improve practice. There are a number of references to an increased awareness by all personnel to report incidences and ensure good environmental outcomes.

The attention to detail in the IEE, the detailed monitoring and reporting of compliance arising from the assessment and the use of the information to improve performance is best practice.

This is a subjective analysis of the reporting. It may be of benefit to gain a more objective measure as to the usefulness of the information reported in enabling better environmental outcomes. But the indication is that Antarctica New Zealand, who hold the bulk of the notification/permits granted after IEEs (as seen by Table 1), is, through the monitoring its performance and reporting on it, practising responsible stewardship.

How other countries assess their performance without the extent or the detail required by the IEE approvals granted by MFAT is unknown, but the indications is that New Zealand is showing good environmental leadership in its own practice.

While a cursory overview of the level of detail of potential environmental impacts and mitigation methods to reduce the impact was made sampling the IEEs from a number of countries, it must be seen in context of establishing whether, in comparing the number of IEEs, it was a case of comparing like for like. The indications were that the IEEs sampled were for similar types of events, and provided detail on the science or the activity (such as hydroponics at a base) and the justification for it but on the whole did not appear to seek as much detail as is required for New Zealand permits. Developing a methodology around a more objective measure would give more definitive conclusion.

The matter of the loss of New Zealand departure tourism to the Ross Sea area was apparent from the fall off of figures in Table 1 but there was no evidence that these departures are now occurring from Australia. Further investigation of this aspect would be needed to find if this is a negative impact of the difficulty in obtaining an approval between one country and another. What was apparent is that the IEEs for various issuing countries were similar in the level of detail and that this is a function of a self-regulated industry through the guidelines of its association, IAATO.

Scott Base Wastewater Case Study

The case study was an opportunity to see at first hand the operation of a plant that avoided potential significant environmental impact. Wastewater management is a major concern on any base, and to operate in a sensitive environment with extreme weather conditions exacerbated by extreme isolation is a challenge.

The plant operates very well and the environmental performance indicators exceed the requirements of the Protocol Annex III. The plant has a small footprint and meets the requirements for best practice both in New Zealand and in the ATS. There were no compliance issues reported. It is understood that potential upgrading of the system is under consideration with the base redevelopment.

International leadership was assessed by examining New Zealand's response to all CEEs, and taking two case studies to consider the response in detail and to evaluate any influence on better environmental outcome achieved. A quantitative analysis was made of New Zealand's contribution to the CEP.

Table 2 shows 19 CEEs circulated to parties of CEP. Information on submissions was available on 15 of these, and excluding New Zealand's own proposal the results show New Zealand submitted on 11 out 14. Of the number of countries who could submit the figures show a range of 6-33% of countries do so. New Zealand is one of a small group of 7 who regularly respond and of the now 37 members only 14 countries have participated in this opportunity to influence improved environmental outcomes.

The two case studies of the new Chinese Base on Inexpressible Island and the gravel runway in Terra Nova Bay (Italy) show a considerable alignment between the New Zealand submission and the WP to the CEP meeting by the ICG that jointly considered the submissions. That in itself is not sufficient to gauge the extent of New Zealand's influence. None of the other submissions, or comments, were available and they may equally have aligned with the ICG's recommendations. But it does show that New Zealand played a positive role in environmental leadership.

That this does not translate into any great influence of the final CEEs is disappointing but it is the nature of the decision making process of the Protocol. There are environmental gains made though, and without this process it would be unlikely that those gains would occur. To this extent New Zealand continues to play a leadership role.

What is of most concern is the lack of assessment of cumulative effects, and the intention to proceed without considering them leads to lost opportunity to achieve potentially better outcomes, such as sharing of facilities to avoid these impacts.

The ice free ground forms only 0.35% of Antarctica in summer. The lichens are extremely slow growing with larger lichens being several hundred years old and some up to an age of 5000 yrs. What is lost will not be replaced. The indigenous Antarctic organisms have evolved to withstand the most extreme conditions. Genetically they promise potential through bioprospecting that could benefit medicine, waste management and food technology in a world increasingly under growing threat of insufficient food (Broady, 2015). The terrestrial ecology of the coastal landscape of Antarctica has already been substantially impacted by human activity and its preservation should be a priority (Bölter & Stonehouse, 2002). This warrants far more attention than the Chinese second draft offers.

The impact of cumulative effects and how to handle them is a topic that needs to be debated by the CEP as the pressure on areas of the coastal margins of Antarctica increases.

The other aspect that is disappointing is the lack of transparency with the public engagement. That there are specific provisions for public comment on all draft CEEs suggests that it must have been of importance to a number of parties at the time of drafting the Protocol. Yet there is paucity of information about the process and there appears little response. There were no public submissions to the Terra Nova runway proposal in spite of the loss of much of a significant long term monitoring site and only two on the Chinese Inexpressible Island station proposal.

In both these cases the timing of the official response in order to meet the demands of the CEP timetable, and the length of the submission period meant that no public submissions would be considered in the official response. Forwarding them directly to a country where there is, pragmatically, very little chance of them being read is not giving the respect to the submitters that their efforts deserve.

The timing issue remains a problem but there is opportunity to improve public engagement. MFAT have explained they do notify stakeholder groups such as the universities and NGOs so the problem may lie further down the chain. New Zealand could show more leadership here in finding ways of improving the initial communication, and providing something more than an acknowledgment to better engage with the public submission process. It takes a lot of effort to make a good submission especially when giving expert comments. This deserves some feedback in response.

Finally the quantitative study on the contribution of working papers to the CEP show New Zealand as the leader. This study affirms the earlier findings of Dudeney and Walton. For both studies, when normalised by GDP, New Zealand was very much at the forefront. Dudeney and Walton (2012) concluded that it showed that New Zealand put great priority on full engagement in Antarctic affairs. The same conclusion can be made for the results of this study which show New Zealand to be an environmental leader.

This methodology was also used by Bartley (2012) in examining comparative contribution of parties to CCAMLR. In this case New Zealand rated much lower, dropping to 7th place over all

but 12th in terms of scientific papers. She suggests this may reflect the relationship between two government departments, the foreign affairs and fisheries, clearly referring to the Ministry of Primary Industries interest in toothfish catches in the Ross Sea. Bartley suggests the anomaly is worthy of further investigation.

Conclusion

The results across a number of parameters considered, national and international indicate that New Zealand models good practice.

New Zealand performs well under the Act demanding a high standard of assessment of environmental impacts and, through its Crown Entity, is ensuring its own practice through the operation of Scott Base and the field events supported by Antarctica New Zealand are meeting compliance with the requirements of the permits and looking to continuous improvement.

Comparison with other parties show a greater emphasis on the second level of assessment, the IEE.

New Zealand has shown a high level of engagement in submitting on the CEEs of other parties, and the 2 case studies show strong alignment with the ICG report. While the outcome may fall short of that sought, some gains are made. New Zealand's contribution to the Committee on Environmental Protection shows the priority New Zealand places on environment protection.

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